

REMARKS

I. STATUS OF THE CLAIMS

Claims 1-21 and 31 stand rejected. Claims 22-30 stand withdrawn. Claim 32 is added. Claims 1-21 and 31-32 are pending.

Claim 1 is amended. Support for amended claim 1 is found at least in FIGs. 2A, 2B, and 2C, and in paragraphs [0018], [0020], [0022], [0028], and [0040]. Claim 9 is amended. Support for amended claim 9 is found at least in paragraph [0023]. Claim 31 is amended. Support for amended claim 31 is found at least in FIGs. 2A, 2B, and 2C, and in paragraphs [0018], [0020], [0022], [0028], and [0040]. These amendments do not add new matter.

Claim 32 is added. Support for new claim 32 is found at least in FIGs. 2A, 2B, and 2C, and in paragraphs [0018], [0020], [0022], [0023], [0027], [0028], [0038], and [0040]. Claim 32 does not add new matter.

II. REJECTIONS UNDER 35 U.S.C. § 102

Claims 1, 3-5, 7-10, 15, 19, 21, and 31 stand rejected as being anticipated by U.S. Patent No. 6,654,248 by Fishley et al. (hereinafter "Fishley"). Amended claim 1 recites, among other elements, "molding compound contacting only an exterior surface of the sloped wall so as to secure the package lid to the package substrate of the packaged semiconductor."

Fishley states that "[a] molding compound **20**, such as plastic, encapsulates the integrated circuit **16** and the lower level of the heat spreader **10** to the package substrate **14**" (Col. 4, lines 18-21) and that "[t]he molding compound **20** as able to flow through the head spreader **10** through the centrally disposed aperture **12**" (Col. 4, lines 41-43). Fishley states that "the primary purpose of the aperture **12** is to allow molding compound, such as plastics, to flow into a top gated mold form and through the heat spreader **10** so as to more uniformly encapsulate an integrated circuit" (Col. 3, lines 51-54). Fishley further states that, "because the molding compound is flowing radially outward from the top center of the package, the flow of the molding compound does not sweep the wires into one another" (Col. 2, lines 45-48).

Fishley does not disclose, and teaches away from, molding compound contacting only an exterior surface of a sloped wall so as to secure a package lid to a package substrate of a packaged semiconductor. Claim 1 and all claims that depend from claim 1 are patentable.

Amended claim 31 recites, among other elements, means for securing the package lid to the package substrate by applying molding compound to only external portions of the sloped wall of the package lid and the exposed perimeter portion of the package substrate. Fishley discloses flowing molding compound through a central aperture in a heat sink to encapsulate an integrated circuit and bonding wires. Fishley does not disclose or suggest claim 31, and claim 31 is patentable.

Amended claim 9, which depends from claim 1, further recites "a vent allowing gases to escape during assembly of the packaged semiconductor to a printed circuit assembly." The aperture **12** of Fishley is not a vent allowing gasses to escape during assembly of the packaged semiconductor to a printed circuit board because the aperture **12** would be plugged during assembly of the packaged semiconductor to a printed circuit board by molding compound injected between the heat spreader **10** and the integrated circuit **16** during encapsulation of the IC. Fishley does not disclose or suggest claim 9, and claim 9 and all claims that depend from claim 9 are further patentable.

Claim 10, which depends from 9, recites that "the vent is provided in a side of the package lid." The Examiner states that "Fishley et al. further teaches a vent (12) provided on the top side of the package lid (10) [see fig. 3]." The Applicant respectfully traverses the Examiner's position.

Claim terms must always be analyzed in light of the teachings of the disclosure as it would be interpreted by one of ordinary skill in the art. The Examiner's characterization of the aperture **12** of Fishley as being on a side of the package lid is strained and unreasonable. FIG. 1A of the instant patent application shows a top **18** of a package lid **10**, and distinguishes the top **18** from a side of the package lid in paragraph [0023]. Similarly, Fishley describes a top gate **26** through which molding compound flows through the centrally disposed aperture **12** (Col. 4, lines 41-43). One of ordinary skill in the art, considering claim 10, the Applicant's disclosure, and the

disclosure of Fishley as wholes, would not consider the aperture **12** of Fishley to be in a side of the package lid. Furthermore, Fishley teaches away from providing an aperture in the side of the package lid because the central location of the aperture in the top center of the heat spreader is desired to flow the molding compound radially outward so that the wires do not sweep into one another (Col. 2, lines 45-48). Fishley does not teach or suggest claim 10, and claim 10 and all claims that depend from claim 10 are further patentable.

III. REJECTIONS UNDER 35 U.S.C. § 103

Claims 2, 6, 16, 17, and 11-14 stand rejected as being unpatentable over Fishley in view of U.S. Patent No. 6,246,115 by Tang et al. (hereinafter "Tang").

Claim 11, which depends from claim 10, recites that the vent comprises a gap in the sloped wall. The Examiner acknowledges that Fishley fails to teach a gap in the sloped wall, and asserts that Tang "shows a gap (321a) in the sloped wall (321) of the package lid (32)." The Applicant respectfully traverses the Examiner's position.

Tang states that "the supportive legs **321** are each formed with a through hole **321a**" (Col. 5, lines 6-7). FIG. 2 of Tang shows these holes **321a** being surrounded and plugged with encapsulant. The holes do not act as a vent as would be understood by one of ordinary skill in the art considering the Applicant's disclosure and claim 11 as wholes.

Tang also distinguishes between the legs **321** and the sides **324** of the heat sink **32** (see Fig. 3, Col. 5, lines 8-20). The holes **321a** are not in the sides **324** of the heat sink, but rather the legs **321**.

Tang must be considered as a whole. Tang shows the openings **326** through which the encapsulant is dispensed as being near the corners of the heat sink (see, e.g. FIG. 1, Col. 4, lines 62-64). Tang also shows the holes **321a** in the legs **321** as being near the corners. This teaches away from the centrally located top aperture **12** of Fishley that allows molding compound to flow radially outward. The modification urged by the Examiner would have required substantial redesign of both the heat sink and mold cavity of Fishley, and would not result in claim 11. No *prima facie* case of obviousness has been established, and claim 11 is further patentable.

Claim 2, which depends from claim 1, recites that the sloped wall has a slope angle between 30 degrees and 60 degrees. The Examiner states that Tang appears to show a sloped wall of about 45 degrees, and asserts that it would have been obvious to one of ordinary skill in the art to include a sloped wall having an angle of between 30 degrees and sixty degrees, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or working ranges involves only routine skill in the art. However, before a parameter can be optimized, it must be recognized as a result-effective variable.

The Applicant teaches that, “at angles less than 30 degrees, the sloped wall takes up too much room on the package substrate” (¶ [0029]), and that “[a]t angles greater than 60 degrees, the force normal to the package substrate decreases” (¶ [0029]). Neither reference cited by the Examiner recognizes these effects, or any effect that would lead to claim 2. Tang teaches away from the second effect by filling the holes in the legs with encapsulant to enforce the bonding between the package lid and the encapsulant, as noted by the Examiner in rejecting claim 11. One of ordinary skill in the art, considering the disclosure of Tang as a whole, would not recognize the slope angle as a result-effective variable, and thus teaches away from the Examiner’s position. Claim 2 is further patentable.

Claim 12, which depends from claim 1, further recites “a rim forming a vertical wall around a top of the package lid.” The Examiner cites Tang for teaching a vertical wall (V1) around a top (322) of the package lid (32)” (see Detailed Action, page 6). In order to establish a *prima facie* case of obviousness, the Examiner must provide motivation for combining the references. No motivation has been provided, and no *prima facie* case of obviousness has been established. Claim 12 is further patentable.

Claim 13, which depends from claim 12, further recites “fiducial marks formed in the rim.” The Examiner considers protrusion P1 or 325 formed in the rim V1 as fiducial marks. The Applicant respectfully traverses. Tang states that injection pins 51 in a mold penetrate the openings 326 on the four corners of the heat sink 32 in order to keep the heat sink in position (Col. 4, lines 64-67). Considered as a whole, Tang discloses using the openings 326 as fiducial marks. Tang describes element 325 as a positioning tongue (Col. 5, line 47) having a curved edge 325a; however, the

positioning tongue **325** is not formed in **V1**, but rather extends beyond **V1** (see, Detailed Action, page 6, FIG. 2). Claim 13 is further patentable.

IV. ALLOWABILITY OF NEW CLAIM 32

New independent claim 32 recites, among other elements, "a semiconductor integrated circuit mechanically and electrically attached to the package substrate with a ball grid array attachment;

a metal package lid having a sloped wall, a top, and a vent allowing gases to escape during assembly of the packaged semiconductor to a printed circuit assembly;

molding compound applied to only external portions of the exposed perimeter portion of the package substrate and external portions of the sloped wall of the metal package lid so as to secure the package lid to the package substrate; and

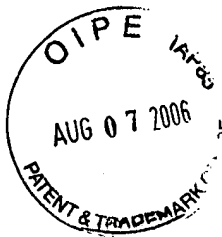
thermal grease disposed between the semiconductor integrated circuit and the top of the metal package lid.

Fishley states that, "because the molding compound is flowing radially outward from the top center of the package, the flow of the molding compound does not sweep the wires into one another" (Col. 2, lines 45-48). Fishley does not disclose or suggest, and teaches away from, a semiconductor integrated circuit mechanically and electrically attached to the package substrate with a ball grid array attachment.

Fishley states that "[a] molding compound encapsulates the integrated circuit and portions of the heat spreader to the package substrate" (Col. 3, lines 7-9). Fishley does not disclose or suggest, and teaches away from, molding compound applied to only external portions of the exposed perimeter portion of the package substrate and external portions of the sloped wall of the metal package lid so as to secure the package lid to the package substrate. Fishley does not disclose, and teaches away from, thermal grease disposed between the semiconductor integrated circuit and the top of the metal package lid. Claim 32 is patentable.

V. REJOINDER OF WITHDRAWN CLAIMS

If any of claims 1-4, 6-9, 21, and 32 are found to be allowable, the Applicants respectfully request the Examiner to rejoin and reconsider withdrawn claims 22-30.



CONCLUSION

The Applicant submits that all claims are now in condition for allowance. Favorable reconsideration and timely issuance of a Notice of Allowance are respectfully requested. Should the Examiner consider necessary or desirable any formal changes anywhere in the specification, claims, and/or drawings, then it is respectfully asked that such changes be made by an examiner's amendment, if the Examiner feels this would facilitate passage of the case to issuance. If the Examiner believes a telephone conference would expedite prosecution of this application, the Examiner is cordially invited to telephone the undersigned at (408) 879-7710.

Respectfully Submitted,

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I hereby certify that this correspondence is being deposited with the United States Postal Service as first-class mail in an envelope addressed to: Commissioner for Patents, P.O. BOX 1450, Alexandria, VA 22313-1450, on August 3, 2006.

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